

Transcript for #97. Sustainable Aviation: A Conversation with United Airlines
Rohini Sengupta, Director, Environmental Sustainability, United Airlines
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Tammy Klein (00:03):

Hi everyone. Welcome to the show today. I am so, so excited. I always say that, but in this case, I really truly am <laugh>. I'm always excited, but I'm really, truly excited to have with me Rohini. Sengupta. Rohini is director, sustainability and decarbonization for United Airlines. So United is the first airline...I've talked SAF in the past - It's sustainable aviation fuel - but United is the first airline to actually join the podcast to actually talk about SAF. So I'm so excited. I want to get into the issues. Rohini, welcome to the program.

Rohini Sengupta (00:43):

Thank you, Tammy. And thank you for having me. Really, really excited to talk about my favorite topic and, and hopefully, a few others after our chat. <laugh>.

Tammy Klein (00:52):

Well, it's one of mine too. So in this low carbon decarbonization world, we're going into this energy transition. So for the listeners who may not be familiar, who don't know what SAF is, can you talk about what it is? And United's really historical involvement in developing and testing and now using the product. It goes back a number of years.

Rohini Sengupta (01:19):

Yeah, it does. Thank you. So SAF, and it's, I totally agree, it's important to get the definitions and the acronyms. We live in an acronym-heavy world in aviation. SAF, it's identical to fossil jet fuel or the jet fuel we use today. And in fact we refer to it as the term conventional jet fuel. So it's identical in properties, but it's made from renewable resources. So what that means is, on a lifecycle basis, it emits fewer greenhouse gas emissions. And so it's actually transitioning to SAF usage is one of the most scalable and readily available in terms of infrastructure mechanisms and technologies to decarbonize the industry because it performs the exact same way as conventional jet fuel. You don't have to build new infrastructure, you don't need to make new tanks, hopefully you just need to make them for more fuel.

(02:20):

But on a lifecycle basis, it can emit up to 85% less greenhouse gasses or greenhouse gas emissions than that conventional jet fuel. And that's really the importance of it. And you know, like you said, Tammy, there is such a rich history we have at United with SAF because we've long believed it's the, it's the primary technology solution to decarbonize not just United, but the industry. So way back in 2011, we actually tested an algae-based jet fuel, which is very interesting on a test flight from Houston to O'Hare. And since then, lots of firsts. So 2016 we started using SAF on a regular basis. It was out of our Los Angeles hub airport at the time. And since then we've added SAF usage to Amsterdam, to San Francisco most recently, and we're anticipating bringing more on in London Heathrow later this year.

(03:26):

And, you know, just because it's being commercially made at some volumes today, it doesn't mean that we have stopped our support and kind of the testing program. So it actually, as recently as late 2021, we flew the first ever passenger flight containing 100% SAF, meaning it's not blended with any conventional jet fuel. But it's actually pure SAF in one of the engines and showing that there is a pathway over time toward replacing our jet fuel with SAF. And it was - I promise - the flight went smooth, I was on it <laugh >. And yeah, I think it's just been really exciting to be able to both flex our operational resources and lend those toward scaling what is such an important technology.

Tammy Klein (04:10):

So you sort of highlighted this a few minutes ago, but how does SAF fit into United's commitment to reach net zero by 2050? And then what other strategies are there? Because I look at it and it's a real tough thing because one can only improve efficiency like so much right now and we don't have alternatives that have been widely discussed out there, like hydrogen, like battery electric. So can you talk a little bit more about that?

Rohini Sengupta (04:44):

Yeah, so I mean, that's exactly how you stated it. You know, the important thing to keep in mind is 98% of our greenhouse gas footprint is associated with combusting jet fuel. So the root, the what is not a complicated question. We sort of figured out the problem there. So for us getting to net zero first and foremost is reducing the amount of fuel we use, but we just can't reduce all the way to zero. We need a liquid fuel, particularly for some of these medium to long haul flights. So the way I look at it is we reduce the fuel we can use through several levers, and then the remainder we have to replace with the sustainable alternative like SAF. We actually just completed an exercise and published a roadmap, our decarbonization roadmap, which shows essentially, it's our business as usual emissions growth through 2050.

(05:37):

And then by levers, operational and technology levers, the ways we're going to reduce that business as usual emissions all the way down to zero by 2050. And so about 45% of it is actually fuel reduction. And that's things like more fuel efficient aircraft and more efficient operations. It's how many seats you put on a plane, those things really are impactful. And I think we can't forget about those levers that were actually very familiar in deploying. It also has, you were alluding to battery electric and hydrogen, it also represents a small wedge, but an important one, which is the transition of our regional aircraft, our smallest aircraft away from, our traditional propulsion to things like battery electric and hydrogen, which are zero carbon. but keep in mind that was 45%.

(06:36):

So of course the remaining roughly 55 is reducing via SAF. And, when we look at that, we're looking at it as the SAF needed to hit net zero, particularly as we think as the SAF market scales in supply. We look at it as an expansion of today's commercial SAF technologies, but also future commercialized technologies taking advantage of better and more sustainable feedstock in the future. So we've kind of broken it out in a way where we're also sort of saying the way we need to transition a SAF market, recognizing it's

very nascent today. But certainly when we get to those scales, it won't just be made one way through one sort of feedstock source.

Tammy Klein (07:23):

Right. So how much SAF does United plan to use in the coming years? It's probably like whatever we can get our hands on, but I'll let you tell it. And what companies is United partnering with and what was that decision selection process? What is that like for you all having to sort of make those decisions?

Rohini Sengupta (07:50):

well there is some element to whatever we can get our hands on. You know, you can't really have the SAF conversation without highlighting the very constrained supply we have today.

Tammy Klein (08:02):

Right? Right, right.

Rohini Sengupta (08:03):

So you know,

Tammy Klein (08:04):

The demand was always there waiting, you know, it's unlike other sorts of fuel types that I've seen over the years in my career where you really had to sort of push the industry involved or whatever to do uptake of a fuel. This, I've always said that in aviation it's completely the opposite. They've always been wanting that fuel to...it's always been like the demand is waiting for the supply, hungry for the supply.

Rohini Sengupta (08:38):

Yeah, exactly. I mean, there's a bit of a chicken or egg just because there's a reason there's a limited supply. And if demand were the only answer, we would've solved it right there, there are just there are reasons why the truth is SAF costs a lot more than jet fuel today. And there are multiple reasons for that. You know, it's overcoming the capital requirements to build net new facilities. It's an arbitrage with other renewable products you could make using the same feedstock. And, in truth, they're just thermodynamic hurdles that we're not going to solve but exist when you want to create a synthetic jet molecule. But to go back to your question, I mean, we today fly on billions of gallons of jet fuel. So we're going to need billions of gallons of SAF.

(09:32):

And that's, that's kind of an eye-popping number. And, we've certainly secured rights to future supply that in aggregate is in the billions, but that needs to be commercialized. And, there are several avenues and levers that can facilitate that. But there's a really limited number of suppliers in the market today and so I think part of it is kind of understanding why that is the case and how can you sort of replicate it. The good news is, to your point, because there is such overwhelming demand, because it is such an important and increasingly important topic we are seeing existing suppliers grow their assets and grow their capacity. So we think production, obviously production is sort of signaled at increasing. We see incumbent oil and gas sort of introducing SAF. There are existing suppliers we want them to transition as

well. If they're going to make fuel, we would like it to be sustainable and we'd like it to be renewable. And then I think what's really encouraging is the innovation and the r and d that we're seeing to really kind of remove the hurdles. Like I don't think basic laws of thermodynamics are going to be undone through academia. Although I, you know, I'm happy to stand corrected and win a Nobel prize.

Tammy Klein (10:59):

Right. Exactly. Exactly. It's like gravity. There's just no getting around that.

Rohini Sengupta (11:04):

Exactly. But I think there are inefficiencies that are just kind of baked in because of the way we've always commercialized and scaled certain technologies. And so what's really encouraging is seeing the pipeline of early stage R&D, low technology readiness level, those opportunities that are ripe for investment and or just, "hey, this technology could be applied toward aviation, did you consider that?" Sometimes that's all it takes. It's, these are aviation's I would say carbon problem is not distinct and alone from the world. And so there are a lot of clean energy dependencies. Today if there's a SAF supplier we are in active conversation and or are purchasing from them and that's the reality of it. But I would love to be in a place where it is as diverse in geography, in supply location as the conventional fuel market is today. I mean, that's really what we're looking to do is replicate something that works in certain parts but doesn't in terms of its feedstock.

Tammy Klein (12:14):

So can you talk about United's SAF program and in particular the Sustainable Flight Fund. I mean, that's a fairly new program that United has and what's been the reaction to the program from customers, from industry, from government, from stakeholders out there?

Rohini Sengupta (12:37):

Yeah. I think the Sustainable Flight Fund is really exciting. You know, we're talking about the early-stage technologies and even mid-stage technologies. United decided a few years ago to launch our United Airlines corporate venture capital fund and there was within the decarbonization vertical of that fund already about a half a dozen companies along the SAF value chain that are part of the investment portfolio. So there was an understanding among our stakeholders and really people like our alliance partners, our airplane OEMs, our technologists in the SAF and renewable space that we were really leading and signing the checks behind it. We were recognized investment in this space. Scaling the availability of these fuels is so critical. Like, let's just invest, right? Because we need to, we need it to grow.

(13:45):

And then the SAF will at that point come. So the Sustainable Flight Fund is really an expansion of that decarbonization vertical we had within United Airlines ventures. And in fact, earlier this year is when we launched the first round of the Sustainable Flight Fund, we raised capital from that ecosystem of stakeholders and essentially, it's increased our investment power. So our anchor partners we launched with are Air Canada, Boeing, JP Morgan Chase, GE Aviation and Honeywell, UOP. And with our investment portfolio, we're also able to secure rights to that fuel. So when I said that we've negotiated billions of gallons of future fuel offtake, that's the supportive demand signal and strategic support that

we can provide to our portfolio companies. And so that kind of the duality of, hey, we're strategic support, it's investment capital, but it's also somebody who is understanding how to get the fuel into the airport and is actually buying it today, has that awareness and is creating a demand signal. It's born a really successful strategy. And this is a very thoughtful investment thesis. It's creating supply, I mean, it really, really is in SAF. But then the other piece is we are starting the response we're seeing has been so overwhelmingly positive. You know, talking to policymakers, talking to other airlines, this isn't a hyper competitive arena. We all need everyone to help scale this industry. And in fact, you can see that in the fact that one of our anchor partners is another airline. So this is debottlenecking

Tammy Klein (15:49):

And de-risking, right? I mean, it's de-risking, that's which is really what's required to scale up some of these technologies now.

Rohini Sengupta (15:56):

Yeah. And we've seen the really large investment capital, the infrastructure investment that is going to be the billions and trillions of dollars we need to actually build these assets. We've seen those markets respond and say, okay, what do you think is, what do you think about this technology? What do you think about this arena? So it's exciting to see that the type of investment that we will need to actually build facilities is watching where even at the earliest stages where we're making investments. And that's, that's really important. We need to not only unlock supply today, but to recognize the orders of magnitude in the future.

Tammy Klein (16:39):

So SAF is, is beginning to scale up just as you were talking about but in your view, is the pace fast enough for what the industry needs? And what do you see and along those lines, what do you see as both the biggest opportunities and the challenges in the space, especially as a customer?

Rohini Sengupta (17:08):

Yeah, I mean, I think this goes back to I mean, firstly it's very encouraging. The SAF scale. It obviously needs to be exponential. And, I think ultimately it does boil down to the fact that SAF is more expensive than jet fuel for all the reasons we chatted through. but there are ancillary mechanisms to lower that green premium essentially relative to jet fuel. And while that major challenge is cost, the opportunity is kind of already underway by way of policy, I think. And that creates that bridge. So, you know, we saw the IRA last year that had the first ever federal level SAF incentive by way of the SAF Blenders Tax Credit and then also a ton of state and local incentives. Even in the past six months, we've seen states like Illinois and Minnesota join existing incentives on the west coast in California and Oregon. So there are talks around implementing more of these kind of add-on incentive structures throughout the country. And so I think that that is really, really critical because that really answers for us. You know, we're talking about you can't change thermodynamics, you can't change the price of other competing products, but you can sort of answer for an externality. And I think that's where policy is a really exciting way and opportunity to debottleneck the constraints we've seen so far.

Tammy Klein (18:48):

So I want to ask you more about that, but I want to come back to something and that concerns feedstock availability and there are concerns, I mean, for some of those pathways especially for hydro processed fatty acids HEFA is what I'm used to calling it that there's a lack of availability. So how concerned is United about that and what do you see kind of on the horizon? Do you think this is different pathways are going to scale up with different feedstocks and this is an issue that's going to take care of itself over time, and then there'll be new feedstocks for production pathways like HEFA. Do you see sort of that all sort of working itself out over the next few years? Or how do you see it?

Rohini Sengupta (19:46):

Yeah, I mean, I think the answer is always and not or, particularly when it comes to SAF pathways. I get asked a lot about picking a winner, and I won't take the bait <laugh >. And I think you framed it Tammy, you framed it really well, which is kind of all these different solves for what is absolutely going to be a feedstock constraint with HEFA. For background, you know, HEFA takes fat soils and greases or fogs because - turn everything into an acronym. <laugh> takes fats, oils, and greases and converts them into fuel, and it's not a matter of if, but when in terms of running out of those fats, oils, and greases so I think that there's kind of two pieces. One is absolutely other pathways.

(20:39):

There is sort of on the horizon, both pathways, like, pathways like that are thermocatalytic. So taking things like woody biomass and with heat and catalyst converting it to SAF. But I also think what's really exciting and promising, particularly maybe latter decade, early 2030s, is alcohol to jet. Yeah. And that's the pathway that takes any alcohol, but the ones we often think about are ethanol, but any alcohol molecule and converts that to as the name suggests to jet. And so we have 17 billion gallons of ethanol in the US. So there already unlocks a size of feedstock constraint and concern that we see. And so that's why we've entered actually joint venture with Tall Grass, who's a major oil and gas infrastructure player, and Green Plains and ethanol producer to explore ways to really best convert those ethanol molecules to jet molecules.

(21:47):

but you know, what we've got, the assets in the ground today are HEFA I mean, you're absolutely right there. So really encouraged by your question, which is will there be other HEFA feedstocks? And I think that's something we're exploring and thinking about more and more. so we're learning you can actually develop new feedstock for HEFA. It's not without innovation, but that's kind of another evolution I see in terms of leveraging what's already built, what's already steel in the ground. but answering for a lock. So you know, I'll give a plug to one of our investment portfolio companies, but they're really exciting. They're called some beta factory and it's synthetic biology, so these bugs are going to eat CO₂. And in just sort of understanding what these bugs could do, they found that some actually eat the CO₂ and can make a lipid molecule. And, to tie that all back together, all these fat soils and greases, at the end of the day, they're just lipids.

Tammy Klein (22:50):

And that's really exciting.

Rohini Sengupta (22:51):

So it looks a lot like soybean oil what these little bugs are turning into. So, you know, the idea that you could actually take something that could eat CO₂, so remove CO₂ and then create a feedstock for existing SAF infrastructure that we're all building and scaling. I mean, that to me is a great circularity story, and I think actually would result in even lower lifecycle greenhouse gas emissions than what we see today.

Tammy Klein (23:20):

And I think carbon intensity is the lower the carbon intensity the better. And that is the name of the game, <laugh>. Yeah. I think at the end of the day, I think it's really exciting to see. There's just so many possibilities out there, and I think given where we are with ESG, the need to really meet net zero investors and others will hold United and other companies' feet to the fire just given where policy is going. and given where the incentives are going and given where I also think the refining industry is going, which they have the ability anyway to produce to switch, I think from, from renewable diesel to SAF, I mean, they have the ability, it doesn't mean they're going to do it, but they have the ability and I think it's going to be an interesting time because what I see it'll be new feedstocks, new technologies and new and then scaling up of existing players and transitioning into that space and I see that happening, you know, frankly before I see battery electric, maybe for short haul flights or even hydrogen, which I think is a longer timeframe for power to liquid fuels for example, that's sort of another solution that's sort of proposed out there. And I think those are longer horizon, what I see is the existing technologies we have improving and continuing to scale up further and further.

Rohini Sengupta (25:00):

Yeah, I totally agree. I think, you know, we don't have a magic wand to do over <laugh> and just create a new, a brand new way of providing energy to aircraft to get people around the world. And it's important to get people around the world. So I think we have to find ways to smartly transition using what's in the ground. We always have to recognize and aim to strive for better. So today's HEFA fuel, it's carbon intensity is not zero. You know, that's for sure the case. But if we wait for power to liquid to scale, we will be emitting a lot more carbon in the meanwhile. And so we need to transition. I guess ultimately, we can't let perfect be the enemy of good here.

Tammy Klein (25:45):

Right. Right. I'm a low hanging fruit gal, <laugh> myself.

Rohini Sengupta (25:50):

But we could remove millions and millions of tons based on what we know how to do today if we just find a way to put the shovels in the ground. Right. So let's go for it. Let's do it.

Tammy Klein (26:03):

<laugh>. So the, the last question that I have, I sort of want to come back around to what you were talking about with respect to policy, because you talked about clean fuel standards, you've talked about the Inflation Reduction Act and that creation for the first time of a sustainable aviation fuel tax credit. You talked about state policies now further incentivizing like in Illinois, Minnesota, others further

incentivizing SAF. Are those policies enough in United's view to really scale up the industry? And if not, what else do you see could be needed out there to really get this industry scaling up further?

Rohini Sengupta (26:46):

Yeah, I think policy as an umbrella is huge. There's sort of the incentive legislations or regulatory pieces that you just mentioned, Tammy, but there's also grant funding. For early stage research academia. we're seeing the DOE and the FAA issue grant dollars for specifically infrastructure to be able to blend SAF with conventional jet fuel for specifically you know, different catalysts that can target a higher SAF yield for the same feedstock. Things like that are areas that there's a government assisted or a government support that certainly is critical, and we're seeing an increase in which is huge. So I want to acknowledge the various structures that the government can sort of play here beyond just enacted policy, which is obviously all too critical. I think the other piece, where this sort of that last little bit is, I touched on it a little bit before, but it's really, how do we make sure that this isn't sort of a siloed problem to solve? I so believe that SAF will only be able to scale as we sort of integrate that need with the broader energy transition power to liquids is a great example. We know that there is an increased adoption of renewable energy around the world, but in North America, Europe, particularly high aviation density areas, we also know that green hydrogen is a huge booming economy. carbon capture is too, these are all the critical building blocks and we need those industries, those clean industries to scale to be able to kind of tackle that final SAF pathway that I completely agree with you is maybe a little bit further along in the future in terms of commercialization.

(28:53):

So I think that, and another great example is corporate customers. we have our Ecos Skies alliance, and that is our corporate customers came to us and said, "hey, my travel emissions are kind of that last little bit that I need to hit net zero. How do we work together?" And that is so powerful. We are using three times as much SAF today because we are doing so in conjunction with our corporate customers and the power of the collective purchase of SAF versus just United going it alone. So I would never suggest that it is just one airline's problem to solve just one industry's problem to solve. And in fact, there's so much advancement happening when we just make sure that we broaden our remit to not just an aviation problem, but sort of a global carbon problem.

Tammy Klein (29:49):

Right, right. Yeah. It's kind of a situation of many hands sort of making lighter work, not to be exactly really cliché <laugh>.

Rohini Sengupta (29:59):

I love that. <laugh>.

Tammy Klein (30:00):

Well, Rohini, thank you so much for coming on the program and talking to us about what United's doing. I think it's so, so important and the strides that the industry has made, I mean, in 10 years, even just a few years ago, you all were talking about SAF and others in the industry were talking about SAF, but the broader public knew very little. I don't even think policymakers really got it. Unless you were like the Department of Energy or, you know, the European Commission DG Energy, you know, like the really you

or IATA or ICAO you know, you really, really didn't know much about it. And now it's really out there and people are becoming comfortable knowing about it, hearing about it, and being on those flights. So, that's only been in the last, I would say within the last five years, not even, maybe even three or four. So it's amazing what has evolved in a relatively quick timeline.

Rohini Sengupta (31:04):

Yeah, I agree. Thank you so much for having me, Tammy, I love talking about this topic, but mostly I just love that every single time I do, I feel like everybody's really eager to understand how we all can help collectively scale SAF. And, that's been really encouraging. So I look forward to hearing more.

Tammy Klein (31:27):

Well, thanks again. Look forward to having you back on the show as things develop <laugh>.

Rohini Sengupta (31:32):

Of course. Take care. Thank you.